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ORIGINAL ARTICLE

Predisposing factors of brain abscess in Ardabil

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ABSTRACT

Background: Brain abscess is a focal intracerebral infection, which begins as a localized area of cerebritis and develops into a collection of pus surrounded by a well-vascularized capsule. In the present study, we studied all patients with brain abscess admitted in Ardabil Fatemi hospital.

Patients and methods: In a retrospective hospital-based study, 24 patients with brain abscess entered the study. Medical records of patients were reviewed from January 2004 to January 2006. Brain abscess was defined as one or more localized lesions with the following characteristics in brain imaging (CT scan): hypodense center with a peripheral uniform ring enhancement following the injection of contrast material, or affected region surrounded by variable hypodense area of brain edema or nodular enhancement or area of low attenuation without enhancement. Predisposing factors for brain abscess were surveyed by reviewing medical records.

Results: The study population included 17 males and 7 females with the mean age (± standard deviation) of 27.0±21.3 years. The following predisposing factors were noted in 22 (91.6%) patients; contiguous focus of infection (sinusitis and chronic otitis media) in 10 (41.6%), congenital heart disease in 5 (20.8%), post traumatic complications in 3 (12.5%), super infected hydatid cyst in 2 (8.3%) and neurosurgical complications in 2 cases (8.3%).

Conclusion: Ear in cerebellar and temporal lobe, frontal sinus in frontal lobe and heart in parietal lobe abscesses should be evaluated for the possible source of infection. Meanwhile, hydatid cyst may be an important risk for brain abscess in endemic areas like Ardabil.

Keywords: *Brain abscess, Predisposing factor, Hydatid cyst.*
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INTRODUCTION

Brain abscess is a focal intracerebral infection, which begins as a localized area of cerebritis and develops into a collection of pus surrounded by a well-vascularized capsule (1). It was an almost uniformly fatal disease before the late 1800s, when surgical techniques (i.e., drainage) led to cure in selected patients. Symptoms may include headache, lethargy, fever, and focal neurologic deficits (2).

The brain is remarkably resistant to bacterial and fungal infection; and brain abscesses in humans are quite uncommon despite the frequency of both overt and occult bacteremia .This resistance is due in part to the brain's abundant blood supply and the relatively impermeable blood-brain barrier formed by the capillary-endothelial tight junctions. Induction of an abscess usually requires direct inoculation of organisms into the animal's brain,

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since brain abscess following experimentally induced bacteremia is rare (3).

Although certain underlying brain pathologies such as previous stroke, intracerebral hematoma and an underlying neoplasm may serve as a nidus for abscess formation, in some cases there is no apparent predisposing brain lesion (4).

Microorganisms can reach the brain by several different mechanisms. The major pathogenic mechanisms of brain abscess formation are spread from a contiguous focus of infection such as middle ear, mastoid cells, or para nasal sinus, infections of molar teeth, congenital heart disease, subacute bacterial endocarditis, penetrating trauma, neurosurgical operation and lung abscess (5).

Bear in mind the possible predisposing factors of brain abscess may not only guide the physicians in selecting the proper empirical antibiotics, but also eliminate the incidence of brain abscess through appropriate prophylactic approaches, i.e., chronic otitis media screening programs in primary schools. Therefore, we studied retrospectively all patients with brain abscess admitted in Ardabil Fatemi hospital

PATIENTS and METHODS

In a retrospective hospital-based study, 24 patients with brain abscess entered the study. Medical records of patients were reviewed from January 2004 to January 2006. All patients were admitted in Fatemi hospital, the only neurosurgical center of Ardabil province that welcomes patients from all around the province.

Brain abscess was defined as one or more localized lesions with the following characteristics in brain imaging (CT appearance): hypodense center with a peripheral uniform ring enhancement following the injection of contrast material, or affected region surrounded by variable hypodense area of brain edema or nodular enhancement or area of low attenuation without enhancement. Diagnosis was rechecked in all surgically treated patients with surgeon's surgical reports.

Heart disease, sinusitis, and chronic otitis media were detected respectively with echocardiogram; CT scans and ENT specialist confirmatory physical exam, respectively. Complicated dental infections, head trauma, IV drug abuse, lung abscesses, penetrating trauma, and any other suspected disease were obtained from history, physical examination and other confirmatory evidences of patient's medical records.

RESULTS

The study population included 17 males and 7 females with the mean age (± standard deviation) of 27.0±21.3 years (a range, 2-82 years). Most of the patients aged 10 to 19 years old (29.2%). Totally, 45.8% of patients were residing in urban and 54.2% in rural areas. Nineteen patients (79.2%) had single abscess while 5 (20.8%) suffered from multiple abscesses. The most common sites for brain abscess were: frontal lobe (37%), parietal lobe (29%), temporal lobe (17%) and cerebellum (17%). Occipital lobe was abscess-free.

Predisposing factors for brain abscess were noted in 22 (91.6%) patients. They were as follow: contiguous focus of infection in 10 (41.6%), congenital heart disease in 5 (20.8%), post traumatic complications in 3 (12.5%), complicated hydatid cyst in 2 (8.3%) and neurosurgical complications in 2 cases (8.3%). As noted earlier, spreading of infection from adjacent infectious site was the most common predisposing factor (sinusitis in 5 and chronic otitis media in another 5 cases).

The most common form of congenital heart disease contributed to brain abscess was tetralogy of Fallot (TOF) (in 4 cases). Table 1 represents the characteristics of patients with brain abscess.

Unfortunately, two patients died (8.3%) and in two patients detectable predisposing factors were not noted.

Table 1. Characteristics of patients with brain abscess admitted to Fatemi hospital in Ardabil.

Group Classification	Predisposing factor	Abscess site	Hospital stay (days)	Therapy	Abscess number	Residency	Sex	Age (yrs)	Outcome
Contiguous site infection	Right chronic mastoiditis	RTL	22	M&S	Single	Urban	Male	27	Alive
	Otitis media	LTL	24	M&S	Single	Rural	Male	2	Alive
	Left chronic otitis media	Cerebellum	7	Medical	Single	Rural	Male	17	Alive
	Otitis media	RTL	12	Medical	Single	Rural	Male	72	Dead
	Left frontal sinusitis	LTL	15	M&S	Single	Urban	Female	50	Alive
	Bilateral maxillary &frontal sinusitis	RFL	11	Medical	Single	Urban	Female	13	Alive
	Chronic otitis media	RTL	10	Medical	Single	Rural	Female	18	Alive
	Frontal sinusitis	RFL	23	M&S	Single	Urban	Male	28	Alive
	Bilateral frontal sinusitis	LFL	13	Medical	Multiple	Urban	Male	45	Alive
	Left frontal sinusitis	LFL	18	Medical	Single	Rural	Male	20	Alive
Congenital heart disease	TOF	RPL	27	M&S	Single	Urban	Male	8	Alive
	TOF	RPL	46	M&S	Multiple	rural	Female	8	Alive
	TOF	RPL	14	M&S	Multiple	rural	Male	9	Alive
	TOF	Cerebellum	12	M&S	Single	rural	Male	14	Alive
	ASD+VSD	RFL	20	M&S	Multiple	rural	Female	5	Alive
Post trauma	Post skull fracture	RFL	21	M&S	Single	rural	Male	82	Dead
	Post skull fracture	Cerebellum	45	Medical	Single	Urban	Male	23	Alive
	Post penetrating trauma	LFL	13	M&S	Single	Urban	Female	54	Alive
Complicated hydatid cyst	Complicated hydatid cyst	LPL	20	M&S	Single	rural	Male	10	Alive
	Complicated hydatid cyst	RPL	17	M&S	Multiple	Urban	Female	13	Alive
Unknown	Unknown	LPL	17	Medical	Single	Urban	Male	28	Alive
	Unknown	RFL	19	Medical	Single	Urban	Male	19	Alive
Neurosurgical complication	Tumor resection	RPL	12	Medical	Single	Rural	Male	43	Alive
	Cerberoperitoneal shunt replacement	Cerebellum	19	M&S	Single	Rural	Male	41	Alive

RTL: Right temporal lobe, **LTL**: Left temporal lobe, **RFL**: Right frontal lobe, **LFL**: Left frontal lobe, **RPL**: Right parietal lobe, **LPL**: Left parietal lobe, **TOF**: Tetralogy of Fallot, **ASD**: Atrial septal defect, **VSD**: Ventricular septal defect, **M&S**: Medical and Surgical

Bacteriologic studies were not reliable since we did not access to anaerobic cultures and commencement of broad spectrum antibiotics prior to blood culture sampling.

DISCUSSION

The most common pathogenic mechanism of brain abscess formation is spread from a contiguous focus of infection, most often in the middle ear, mastoid cells, or paranasal sinuses.

The number of brain abscesses that are associated with otitis media has been decreasing but paranasal sinusitis continues to be an important condition predisposing to brain abscess and the frontal lobe is the predominant abscess site. Dental infections are a less common cause of brain abscess and the frontal lobe is the usual site of the abscess after dental infection (6).

In our study the most common location for abscesses in patients who had congenital heart disease was parietal lobe (3 from 5) and location of

brain abscess in spreading from adjacent sites was dependent to site of primary infection. Frontal and temporal lobe abscess were seen in relation to frontal sinusitis and chronic otitis media, respectively. Parietal lobe was affected most frequently in patients who had congenital heart disease. Cerebellum was affected in different conditions including: otitis, skull fracture, post cerberoperitoneal shunt replacement and TOF.

Seeding of the brain presumably occurs via transit of infecting bacteria through the valve less emissary veins that drain infected regions and permit either direct or retrograde flow into the venous drainage systems of the brain (7).

Lu in Taiwan studied brain abscesses over a period of 15 years and reported his experience with 123 patients. The most common sites for brain abscess were the frontal lobe (33%), followed by the temporal lobe (20%) and temporo-parietal lobe (10%). Predisposing factors for brain abscess were unknown in 44 cases (35%), however, other factors were as follow: hematogenous in 32 (26%), post neurosurgical in 19 (15%), contiguous from otic infection in 17 (14%), contiguous from sinuses in 11 (9%), head trauma, post-neurosurgical and nosocomial infections were also noted in his study (8).

Predisposing factors for brain abscesses in 53 cases in Pao-Tsuan study in Taiwan were: otic infection (19%), penetrating trauma (19%), bacterial endocarditis (9%), odontogenic (8%), pulmonary infection (6%), sinusitis (6%), congenital heart disease (4%), and wound and skin infections (2%) (9).

Domingo studied presentation, treatment and outcome of 98 children with brain abscess at Red Cross War Memorial Children's Hospital in Cape Town, in which, middle ear disease and trauma were the commonest sources of infection found in 60% of patients (10).

In a retrospective study designed by Fica in Santiago on 30 patients admitted for brain abscess, contiguous source of infection was identified in 40% of cases, direct inoculation secondary to trauma or neurosurgery in 23.3%, and a distant source in 23.3%. Temporal and frontal lesions were predominant (11).

In one prospective study for determination of brain abscess incidence in cyanotic heart disease by Piper, 483 patients were followed; the incidence of brain abscess was 0.45% per year. It was higher (0.57%/year) for patients with tetralogy of Fallot where the cumulative risk within the first two decades of life was 12.1 ±1.7 % (12).

The aforementioned studies are more or less in agreement with ours, however, it should be emphasized that epidemiology of brain abscess has changed with the increasing incidence of opportunistic infections in immunocompromised patients, particularly solid organ and bone marrow transplant recipients, and the decreasing incidence of brain abscess related to sinusitis and otitis (13).

Brain involvement in hydatid disease occurs in 1-2% of all Echinococcus granulosus infections (14). Although secondary infection of intracranial hydatid cysts is extremely rare, Turkoglu in Ankara reported secondary infection of hydatid cyst due to Clostridium ramosum, which is an extremely rare infectious pathogen in neurosurgical practice (15).

Co-existence of brain abscess and neurocysticercosis is a rare entity, but it occurs occasionally and acts as predisposing factor for brain abscess formations in some developing nations like Nepal (16).

In conclusion, ear in cerebellar and temporal lobe, frontal sinus in frontal lobe and heart in parietal lobe abscesses should be evaluated for the possible source of infection. Meanwhile, hydatid cyst may be an important risk for brain abscess in endemic areas like Ardabil.

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REFERENCES

1. Mathisen GE, Johnson JP. Brain abscess. Clin Infect Dis 1997;25:763–81.

2. Canal DJ. William McEwen and the treatment of brain abscesses: Revisited after one hundred years. J Neurosurg 1996;84:133–42.

3. Molinari GF, Smith L, Goldstein MN, Satran R. Brain abscess from septic cerebral embolism: an experimental model. Neurology 1973;23:1205–10.

4. Mathisen GE, Johnson JP. Brain abscess. Clin Infect Dis 1997;25:763–81.

5. Yen PT, Chan ST, Huang TS. Brain abscess: with special reference to otolaryngologic sources of infection. Otolaryngol Head Neck Surg 1995;113(1):15-22.

6. Tunkel AR, Wispelwey B, Scheld MW. Brain abscess. In: Mandell GL, Bennet JE, Dolin R, eds. Mandell, Douglas, and Bennet's principles and practice of infectious diseases. 5th edition. Philadelphia: Churchill Livingstone. 2000;p:1016-25.

7. Saba MI. Surgical management of missile injuries of the head. In: Schmidek HH, Sweet WH, eds. Operative neurosurgical techniques. 3rd ed. Philadelphia: W.B. Saunders. 1995;p:89–104.

8. Lu CH, Chang WN, Lin YC, Tsai NY, Liliang PC, Su TM, Rau CS, Tsai YD, et al. Bacterial brain abscess: microbiological features, epidemiological trends and therapeutic outcomes. Q J Med 2002;95:501–9.

9. Kao PT, Tseng HK, Liu CP, Su SC, Lee CM. Brain abscess: clinical analysis of 53 cases. J Microbiol Immunol Infect 2003;36(2):129-36.

10. Domingo Z, Peter JC. Brain abscess in childhood. A 25-year experience. S Afr Med J 1994;84(1):13-15.

11. Fica CA, Bustos GP, Miranda CG. Brain abscess: about a clinical series of 30 patients. Rev Chilena Infectol 2006;23(2):140-9.

12. Piper C, Horstkotte D, Arendt G, Strauer BE. Brain abscess in patients with cyanotic heart defects. Z Kardiol 1994;83(3):188-93.

13. Calfee DP, Wispelwey B. Brain abscess. Semin Neurol 2000;20:353–60.

14. Tuzun Y, Kadioglu HH, Izci Y, Suma S, Keles M, Aydin IH. The clinical, radiological and surgical aspects of cerebral hydatid cysts in children. Pediatr Neurosurg 2004;40(4):155-60.

15. Turkoglu OF, Solaroglu I, Tun K, Beskonakli E, Taskin Y. Secondary infection of intracranial hydatid cyst with Clostridium ramosum. Childs Nerv Syst 2005; 21(11):1004-7.

16. Gurung Gh, Shrestha B, Shah TC, Pokhrel LR, Sayami G, Shilpakar SK. Unusual presentation of neurocysticercosis: report of two cases. Nepal Journal of Neuroscience 2005;2(1):185-89.